

MLCPAC STANDARD SPECIFICATION 074.1
WELDING OF DETACOUPLE STRUCTURAL TRANSITION JOINTS

1 SCOPE

1.1 This specification provides requirements and guidance for joining of aluminum and steel plate or sheet using Detacouple explosion-bonded structural transition joints (consisting of 5086 or 5456 alloy aluminum bonded to ASTM 516, Grade 60 steel with an 1100 aluminum interlayer) on Coast Guard cutters and boats.

2 REFERENCES

Coast Guard Drawings: None

Enclosed Figures:

Figure 1: Detacouple Transition Joints, Various Designs

Figure 2: Butt Weld Design, Detacouple Transition Joint

Figure 3: Weld Edge Preparations

Applicable Documents:

American Welding Society, AWS B2.1-84; Standards for Welding

Procedure and Performance Qualification

American Welding Society, AWS D3.5-85; Guide for Steel Hull Welding

American Welding Society, AWS D3.7-83; Guide for Aluminum Hull Welding

MIL STD-271F; Requirements for Nondestructive Testing Methods

MIL-STD-1689A; Fabrication, Welding, and Inspection of Ships
Structure

3 REQUIREMENTS

3.1 Welding Process. Perform all aluminum Detacouple welding using the direct current, reverse polarity power gas metal arc (GMAW) process. The flat and horizontal positions should be used. Where GMAW equipment is not available or obtainable, gas tungsten arc (GTAW) processes may be used with the specific approval of Coast Guard Inspector. Perform all steel to steel Detacouple welding using the GMAW, GTAW, Short Arc (also called Machine General Metal Arc Welding), or Shielded Metal Arc Welding (SMAW) processes.

3.2 Shielding Gas:

3.2.1 For the aluminum welds to the aluminum side of the Detacouple joint, use a shielding gas with a welding grade mixture of 75% helium and 25% argon. For the steel welds to the steel side of the Detacouple joint, use CO2 shielding gas. If the Short Arc process is used, use a 75% helium - 25% CO2 shielding gas.

3.3 Electrode Materials:

3.3.1 For welding aluminum on the Detacouple joint, use either 5356 alloy or 5556 alloy aluminum electrode materials.

3.3.2 The steel electrode material for welding the steel side of the Detacouple joint must meet approved welding specifications for welding structural carbon steel in accordance with AWS D3.5-85.

3.4 Joint Preparation:

3.4.1 Detacouple bars shall be prepared for welding by sawing, machining, or grinding. Flame cutting and plasma cutting are not permitted because of the potential for heating the Detacouple bond zone above 600oF.

3.4.2 Ensure the weld area and at least 1/2" from the expected toes of the weld are clean, dry, and free of foreign materials such as paint, oil, grease, excessive scale, slag, oxide, nicks, gouges, and irregularities. Degreasing for removal of soils and contaminants may be done with commercial solvents and, if contaminants are excessive, manual or power-driven wire brushes. Use only stainless steel brushes on aluminum.

3.4.3 Fillet Welds: Figure 1 shows several typical joint arrangements. Maintain minimum material separation at the joints to minimize distortion.

3.4.4 Butt Welds: Prepare joints in accordance with Figures 2 and 3, ensuring the ends of the bars to be joined are beveled as shown.

3.4.5 Minimum Bend Radius: The Detacouple bars may be bent around a curved surface. The minimum bend radius in either the vertical or horizontal plane shall not be less than 3T, where T is the bar thickness or width.

3.5 Temperature Control:

3.5.1 Do not preheat the Detacouple transition joint. Control welding procedures so that the temperature at the aluminum-steel bond remains below 600oF. At temperatures in excess of 600oF, brittle intermetallic compounds may form at the bond zone due to interdiffusion of aluminum and iron. In typical GMAW welding of a structural member of the design shown in Figure 1(a), the bond zone temperature will rarely exceed 450oF.

3.5.2 Apply a temperature monitor such as "Tempilstik" or "Tempilaq" to the aluminum-steel interface to determine temperature during welding.

3.6 Welding Procedure. Welding procedures shall follow AWS guidelines for welding steel and aluminum in accordance with AWS D3.5-85, AWS D3.7-83 and MIL-STD-1689.

3.6.1 Fillet Welds: Detacouple steel and aluminum fillet weld procedures shall be in accordance with AWS

D3.5-85, AWS D3.7-83 and MIL-STD-1689. Adjust welding parameters to provide a smooth, full-penetration weld bead with no undercutting. The weld bead shall have a flat-to-concave contour. Use stringer beads to maintain low bond zone temperatures. Where more than one weld pass is required, short interpass cooling periods may be required to avoid excessive temperatures. The fillet size shall be equal to or slightly greater than the thickness of the thinnest member of the joint.

3.6.2 Butt Welds: The bars to be joined, prepared as shown in Figures 2 and 3, shall be butted end to end and secured firmly. Weld butt joints in accordance with AWS D3.5-85, AWS D3.7-83 and MIL-STD-1689.

Complete first. Use several short stringer passes to minimize bond zone temperatures. Then make the aluminum weld, again using stringer passes. Adjust welding parameters to provide a smooth, full-penetration

weld bead. Short interpass cooling periods may be required to maintain acceptable bond zone temperatures. Perform postweld hammer peening of the 1/4" non-welded space between the aluminum and steel, on each side of the joint, to ensure a leaktight joint.

Page 2 of 3

3.7 Inspection:

Dye penetrant inspect all welds in accordance with MIL STD-271. Repair weld bead cracks, laps, or undercutting.

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Questions or concerns, contact Ms. Marda Stothers

Page 3 of 3

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